THE LOCKHEED 6⅞" VACUUM SERVO UNIT

Description

The vacuum servo unit provides the driver with a degree of assistance when applying the foot brakes and it is installed in the hydraulic system between the master cylinder and the four brake calipers. The servo unit consists mainly of a servo piston, a hydraulic slave cylinder and an air control valve ; power for its operation is supplied by matching atmospheric pressure against the partial vacuum from the inlet manifold.

When the servo unit is in the released position, the servo piston is held " off " by means of a spring and whatever degree of vacuum exists in the vacuum reservoir is also present on each side of the booster piston.

As the brake pedal is depressed, hydraulic pressure created by the master cylinder causes the air control valve to admit atmospheric pressure which acts upon the outer face of the servo piston driving it inward and a rod attached to its centre boosts the hydraulic pressure within the slave cylinder thus assisting the driver in applying the brakes without any increase of foot pressure.

Operation (Fig. 21)

When the vacuum servo is at rest the air valve piston D and diaphragm assembly A are in the normal position with the vacuum valve B, of the combined vacuum and air valve B and C, open and with the air valve C closed, the latter being maintained in that position by a conical spring.

A pipe connection included in the slave cylinder body communicates with the vacuum reserve tank so that when the engine is running, vacuum is present within the chambers P and Q. Additionally, whatever degree of vacuum exists within chamber P will also be present in chamber N, through drillings in the conical centre of the diaphragm assembly A and in the chamber R through the external pipe. The air valve C, at the top end of the combined vacuum and air valve B and C, is held closed not only by the aforementioned spring but by the pressure differential across it, as atmospheric pressure is also present on the spring side.

Upon depressing the brake pedal, brake fluid is displaced from the master cylinder to the brake calipers via the slave cylinder incorporated in the vacuum servo unit and passes through a central drilling in the slave cylinder piston H, cup J, spring guide K and to the pipe line through adaptor M.

Meanwhile the hydraulic pressure generated by the master cylinder is felt upon the inner face of the air valve piston D which is displaced against the load of the centre diaphragm spring, this movement deflects the central portion of the diaphragm A until it closes to the vacuum valve B and the seal thus formed isolates the vacuum source from the chamber N, the pipe F and the chamber R.

Continued movement of the air valve piston D, due to a further build-up of pressure in the hydraulic system opens the air valve C, at the top of the combined air valve B and C permitting air to enter chamber N and pass to the chamber R via the external pipe F.

This reduction in the degree of vacuum, outward of the servo piston, causes the latter to move inward transmitting movement to the push rod E allowing it to contact the slave cylinder piston H, seal off the drilling in its centre, thus creating a locked line of brake fluid in the hydraulic system between the slave cylinder and the brake calipers when continued movement of the servo piston will increase the hydraulic pressure in the slave cylinder and the hydraulic system to the brake calipers, thereby assisting the driver in applying the brakes.

The reduction of the vacuum within the chamber N results in the creation of a pressure difference across the diaphragm A in opposition to the force applied by the master cylinder to the air valve piston D, when these opposing forces balance, the inward deflection of the diaphragm A allows the air valve C, at the top of the combined air valve B and C, to close on its seat and prevent any further entry of air.

Greater effort upon the brake pedal increases the hydraulic pressure upon the air valve piston D which re-opens the air valve C, at the top of the combined air valve B and C and allows more air to enter chamber R and thus a greater effort is performed by the servo piston ; when opposing forces on the diaphragm A are once more in balance the air valve C will again close on its seat. It will be apparent therefore, that the diaphragm A acts as a proportioning device, ensuring that the performance of the vacuum servo unit is substantially progressive.

When the brake pedal is released, hydraulic pressure is removed from the air valve piston D, allowing the diaphragm spring to return the diaphragm A to its

normal position and thereby reconnecting the chambers N and R to the vacuum reserve tank. The return spring in the servo cylinder is then able to move the vacuum servo piston to the " off " position, causing the push-rod E to move away from the slave cylinder piston and so permit the brake fluid to return to the master cylinder and fluid reservoir.

It will be appreciated from the foregoing that although the servo assistance achieved is largely due to the vacuum supply, it will be realised that with the absence of outside air no such assistance would ever be maintained. Therefore, the cleanliness of the vacuum servo air cleaner cannot be over emphasized and it must be cleaned at the interval specified and when, after cleaning, a substantial increase of brake efficiency is noticed, the air cleaner must be serviced more frequently.

Removal

Open the engine compartment, firmly apply the handbrake, jack up the front of the car, remove the right-hand roadwheel and drain the hydraulic system at that brake caliper.

Remove the air cleaner hose from the central port in the air valve cover by slackening the hose clip, detach the vacuum reserve tank hose from the large

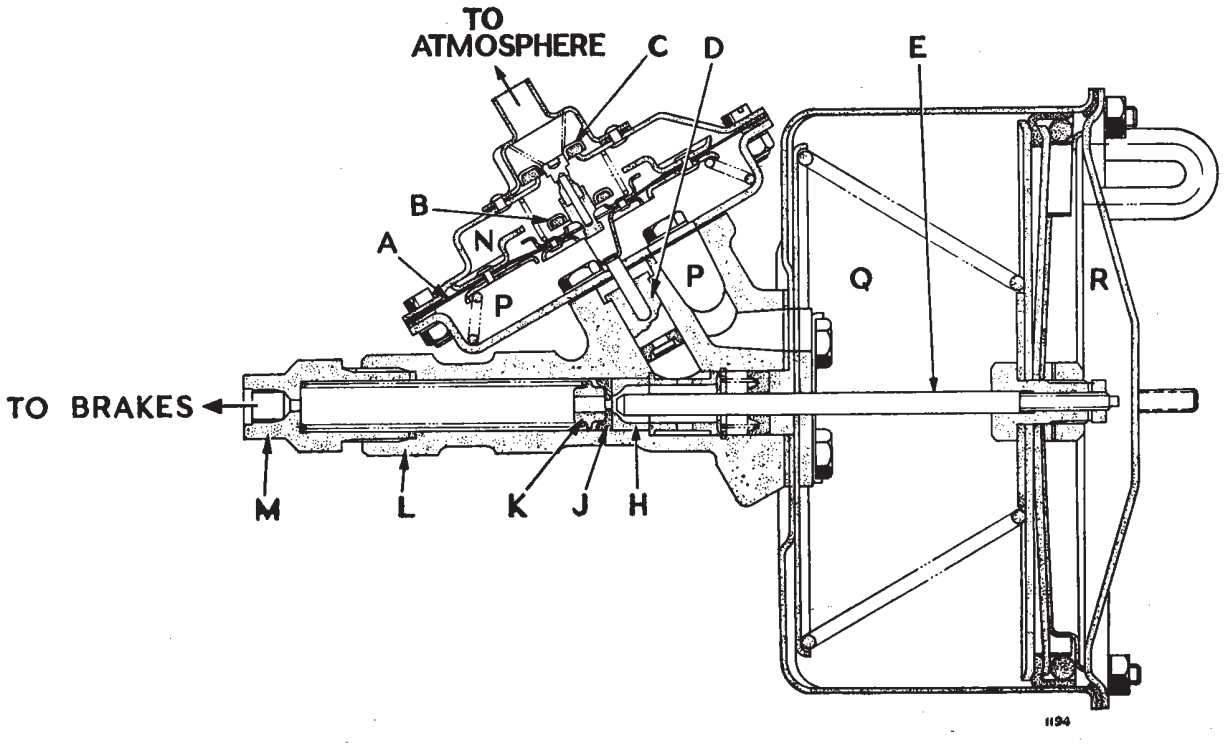

Fig. 21. Sectioned view of 6¾" servo unit

A. Diaphragm assembly
B. Vacuum valve
C. Air valve
D. Air valve piston
E. Servo piston push rod
H. Slave cylinder piston
J. Rubber cup
K. Spring guide
L. Vacuum passage between chambers P and Q
M. Adaptor
N. Chamber, above diaphragm assembly
P. Chamber, below diaphragm assembly
Q. Chamber, inner (vacuum) side of servo piston
R. Chamber, outer side of servo piston ; vacuum when brakes are off, atmospheric pressure when brakes are being applied.

slave cylinder connection by withdrawing a banjo bolt, remove the rigid hydraulic pipe lines from the top and end slave cylinder connections by withdrawing the two union nuts.

Detach the servo unit clamp and support block on the cylindrical body of the slave cylinder from the right-hand wing valance inside the engine compartment by removing two nuts and bolts. Withdraw the vacuum servo unit and supporting cowl from inside the right-hand front roadwheel arch by removing eight bolts. Detach the vacuum servo unit from the supporting cowl by removing three nuts.

Dismantling (Fig. 22)

Ease the flexible hose on the air valve cover to servo cylinder pipe to one side. Identify the circumferential position of the servo cylinder end cover and the position of the three long bolts. Remove the servo cylinder end cover and gasket from the servo cylinder, exercising care to control the released tension of the servo piston slave cylinder push rod assembly and return spring from the servo cylinder. Do not disturb the position of the slave cylinder push rod unless it is absolutely necessary, this can be effected by tapping the push rod to the hexagon head of the centre piece.

Grip the slave cylinder push rod in the protected jaws of a vice and remove the small nut from the second end of the push rod without disturbing the position of the servo piston. Grip the large hexagon of the servo piston centre piece in the vice and remove the components mounted on the centre piece by detaching a nut at the opposite end, commencing with the end stop with wick mounted thereon by the barbed wick retainer, piston plate, leather cup, ' O ' ring seal, second piston plate and locating washer ; the centre piece can now be removed from the vice and the small nut fitted to the protruding threaded end of the slave cylinder push rod, exercising care not to disturb the circumferential position of either component part.

Remove the slave cylinder body end gasket from the front of the servo cylinder by withdrawing four bolts and an abutment plate inside the servo cylinder and withdrawing the spigot, rubber cup, cup spreader and spring from inside the slave cylinder bore. Withdraw the spring, spring guide, rubber cup and slave cylinder body by withdrawing the end adaptor and ejecting the components through the threaded end of the slave cylinder bore utilizing a soft nosed drift. Remove the washer and distance piece from the servo cylinder end of the slave cylinder body by withdrawing the internal circlip.

Identify the circumferential position and remove the air valve cover and gasket from the control valve housing exercising care to control the released tension of the two diaphragm springs. Withdraw the diaphragm, gasket and spring. Remove the control valve housing and gasket from the slave cylinder body by withdrawing four bolts. The combined air valve cannot be removed from the air valve cover.

Expel the air valve piston from the slave cylinder body by closing the straight through bore at both ends and applying low air pressure to the small port in the side of the slave cylinder body. Remove the rubber seal from the bottom end of the air valve piston.

Assembling (Fig. 22)

Assembling is the reverse of the removal sequence but particular attention must be given to the following points :—

(i) That the hydraulic system component parts are liberally coated with brake fluid and the leather cup, wick and servo cylinder are liberally coated with Shell Tellus 33 oil ; it is important that the latter oil is not allowed to infiltrate into the hydraulic system or to contact any of the non-metallic component parts therein.

(ii) That the air control valve housing and gasket are secured to the side face of the slave cylinder and the air valve cover fitted according to the circumferential indentification marks align and bolts and screws tighten to 100/120 and 150 lbs./ins. respectively.

(iii) That a servo piston assembly ring is fabricated to the following dimensions :

Internal diameter ..	6.920—6.910″ (175.77—175.51 mm.)
External diameter .. (approx.)	7.050″ (179.07 mm.)
Depth..	1.000″ (25.4 mm.)

A section cut from a discarded servo cylinder is a speedy solution.

(iv) That the servo piston assembly ring is laid on a bench top and the large piston plate is positioned inside turned up edge face first, followed by the leather cup flat face first, a rubber ' O ' ring and a second piston plate flat face first the ' O ' ring being aligned to the centre drillings in the piston plates. The wick is positioned inside the leather cup followed by the metal retainer, barbs outermost and push the bent end of the retainer inward

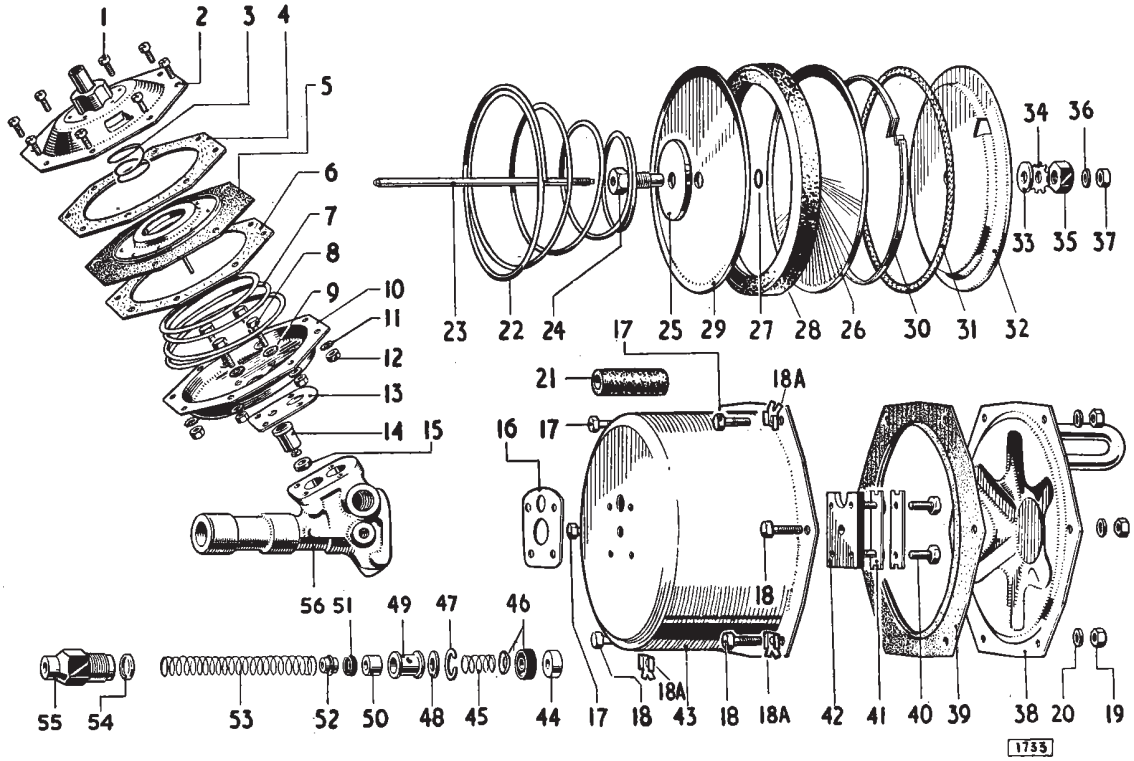

Fig. 22. Exploded view of 6⅞" servo unit.

1. Valve cover screws
2. Valve and cover assembly
3. Diaphragm return spring
4. Gasket
5. Diaphragm
6. Gasket
7. Diaphragm balance spring
8. Valve housing bolts
9. Shakeproof washers
10. Valve housing
11. Shakeproof washers
12. Nuts
13. Gasket
14. Air valve piston
15. Piston seal
16. Gasket
17. Short bolt
18. Long bolt
18a. Tab washer
19. Nut
20. Shakeproof washer
21. Connecting hose
22. Servo piston return spring
23. Servo/slave cylinder push rod
24. Adjusting nut
25. Locating washer
26. Outer piston plate
27. Piston plate ' O ' ring
28. Leather cup
29. Inner piston plate
30. Wick retainer
31. Wick
32. End stop
33. Washer
34. Shakeproof washer
35. Nut
36. Copper washer
37. Nut on push rod
38. Servo cylinder cover and pipe
39. Gasket
40. Bolt
41. Tab washer
42. Abutment plate
43. Servo cylinder body
44. Spigot
45. Short spring
46. Spigot cup
47. Circlip
48. Washer
49. Distance piece
50. Piston
51. Piston seal
52. Spring guide
53. Long spring
54. Copper washer
55. Adaptor
56. Slave cylinder body

and backwards to engage the fork with the tongue of the second end.

Place the piston end stop, flat face first, on top of the wick and retainer so the cutaway portion of the end stop locates the join of the wick retainer and leave the complete assembly inside the ring.

(v) That the servo cylinder push rod is fitted to the servo piston centre piece and mounted by the hexagon of the latter in a vice exercising care not to damage the highly polished face of the push rod, lift the servo piston, assembled in the ring, from the bench top and with a locating washer mounted on the threaded shank of the centre piece or the piston and stop is upward and secure with a backing washer, shakeproof washer and nut, fit a copper washer and nut to the protruding thread of the push rod.

(vi) That the inside of the servo cylinder is smeared with lubricant and the piston return spring, large end leading, inserted inside ; engage the servo piston with the small end of the spring and apply sufficient pressure to move the servo piston into the cylinder from the assembly ring, remove the latter and depress the latter several times to ensure it returns unassisted and there is no excessive friction between the leather cup and cylinder face, pour 25 c.c.'s of the specified servo cylinder lubricant into the end stop of the servo cylinder so it can soak into the wick and leather cup while exercising care to ensure the spring does not eject the piston.

(vii) That the rubber gasket is located on the inside face of the end cover with a smear of lubricant and so its shape conforms to the inside contour of the end cover, this is offered up to the servo cylinder so the circumferential identification markings align and secure temporarily with the three short bolts.

(viii) That the servo cylinder push rod and slave cylinder clearance is checked and adjusted by inserting the slave cylinder piston, hollow end first, to the bottom of the slave cylinder bore and utilizing a depth gauge measure the depth of the slave cylinder piston below the end face of the slave cylinder bore and the depth gauge moved to the centre and the depth of the push rod end face below the end face of the slave cylinder bore is measured. The difference is calculated by subtracting the slave cylinder depth dimensions from the push rod depth dimensions and this should be between 0.060″—0.070″ (1.52—1.78 mm.). The clearance is adjusted by removing the servo cylinder end cover and while preventing the servo piston from being ejected, slacken the small nut in the centre of the stop plate and rotating the end of the push rod with a screwdriver, then tightening the nut ; one rotation of the push rod moves the push rod 0.035″ (0.89 mm.) rotating the screwdriver clockwise reduces the clearance while anti-clockwise rotation increases it.

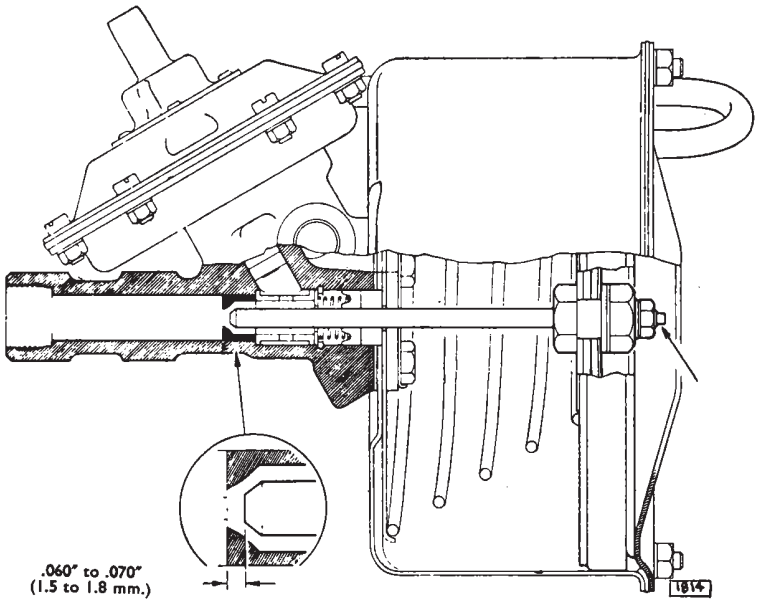

Fig. 23. When assembled there must be .060″ to .070″ (1.5 to 1.8 mm.) clearance between the end of the push rod and the piston. The clearance is adjusted by means of a screwdriver at the point indicated by the arrow.

Refitting

Refitting is the reverse of the removal procedure but particular attention must be given to the following points :—

(i) That rubber grommets together with the spacers inside are fitted to the three mounting studs of the vacuum servo unit and the slave cylinder support block.

(ii) That the hydraulic system is bled of air as detailed under " Bleeding the Hydraulic System ".

(iii) That the vacuum servo air cleaner is serviced.